

REMARKS

Claims 18 to 50 are pending.

Attached hereto is a marked up version of the changes made to the claims. A copy of the replacement Abstract and replacement pages of the Specification are also attached. No new matter has been introduced into this application by reason of the changes to the Specification and the new claims presented herewith. Applicants submit that the present application is now ready for examination on the merits. If, for any reason, the Examiner feels that an interview would be helpful to resolve any remaining issues, he is respectfully requested to contact the undersigned attorney at (312) 321-4229.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE.

What is claimed is:

18(new). A method for measuring the concentration of at least one component of a liquid biological sample before analysis of said sample by an in vitro diagnostic method, said component being apt to interfere with the measurement of a target analyte by means of said diagnostic method, said measuring method comprising

(a) measuring a first extinction spectrum $E_1(\lambda)$ of said liquid sample in a first selected wavelength range $\lambda = \lambda_{1,1}$ to $\lambda_{1,n}$, and

(b) fitting an approximated spectrum $\bar{E}_1(\lambda)$ to said first measured extinction spectrum $E_1(\lambda)$, said approximated spectrum $\bar{E}_1(\lambda)$ being a combination of:

a predetermined approximation function $E_{d1}(\lambda, a_{i,S1})$ for the background extinction, with $a_{i,S1}$ being coefficients and i ranging from zero to at least one, and
a predetermined extinction spectrum $E_{S1}(C_{S1}, \lambda)$ of a first pure component of concentration C_{S1} of the components to be determined,

said fitting being performed by varying said concentration C_{S1} of said first interfering component and at least two of said coefficients $a_{i,S1}$, so that the deviation between said first measured extinction spectrum $E_1(\lambda)$ and said approximated spectrum $\bar{E}_1(\lambda)$ is minimized in order to determine the concentration of said first interfering component, and said first selected wavelength range being so selected that the concentration C_{S1} of said first interfering component can be determined unambiguously.

19(new). The method according to claim 18, wherein said approximated spectrum $\bar{E}_1(\lambda)$ is the sum of said predetermined approximation function $E_{d1}(\lambda, a_{i,S1})$ for the background extinction, and said predetermined extinction spectrum $E_{S1}(C_{S1}, \lambda)$ of said pure first component of concentration C_{S1} .

20(new). A method according to claim 18, further comprising

(a) measuring at least one further extinction spectrum $E_2(\lambda)$ of said liquid sample in at least one further selected wavelength range $\lambda = \lambda_{k,1}$ to $\lambda_{k,n}$, with $k \geq 2$, and

(b) fitting at least one further approximated spectrum $\bar{E}_2(\lambda)$ to said at least one further measured extinction spectrum $E_2(\lambda)$, said at least one further approximated spectrum $\bar{E}_2(\lambda)$ being a combination of

a predetermined approximation function $E_{dk}(\lambda, a_i, s_k)$ for the background extinction, with i ranging from zero to at least one,

previously determined extinction spectra $E_{SL}(C_{SL}, \lambda)$, with L varying from $L=1$ to $k-1$, of $k-1$ pure components previously determined, and

a predetermined extinction spectrum $E_{Sk}(C_{Sk}, \lambda)$ of a k -th pure component of concentration C_{Sk} to be determined,

said fitting being performed by varying the concentration C_{Sk} and at least two of the coefficients a_i, s_k so that the deviation between measured spectrum and approximated spectrum is minimized, in order to determine the concentration of the second component, said at least one further selected wavelength range being so selected that the concentration C_{Sk} of said k pure component can be determined unambiguously.

21(new). A method according to claim 20, wherein said approximated spectrum $\bar{E}_k(\lambda)$ is the sum of said predetermined approximation function $E_{dk}(\lambda, a_i, s_k)$ for the background extinction, said previously determined extinction spectra $E_{SL}(C_{SL}, \lambda)$, with L varying from $L=1$ to $k-1$, of $k-1$ pure components previously determined, and said predetermined extinction spectrum $E_{Sk}(C_{Sk}, \lambda)$ of said k pure component of concentration C_{Sk} .

22(new). The method according to claims 19 or 20, wherein at least one of the functions $E_{dk}(\lambda, a_i, s_k)$ with $k \geq 1$, are of the form

$$f_k(\lambda, a_{i,k}) = \sum_{i=0}^n a_{i,k} \lambda^i$$

with $n \geq 1$.

23(new). The method according to claim 22 wherein all of the functions $E_{dk}(\lambda, a_{i,Sk})$ with $k \geq 1$, are of the form

$$f_k(\lambda, a_{i,k}) = \sum_{i=0}^n a_{i,k} \lambda^i$$

with $n \geq 1$.

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24(new). The method of claim 22, wherein $n = 1$.

25(new). The method of claim 23, wherein $n = 1$.

26(new). The method according to claims 18 or 20, wherein said fitting of said approximated spectra $\bar{E}_k(\lambda)$, with $k \geq 1$, to said the measured values of extinction spectra $E(\lambda_i)$, with $i=1$ to N , N being the number of measured values, is done by a least squares fitting method.

27(new). The method according to claims 18 or 20, wherein the sample is marked at least anomalous if the determined concentrations C_{Sk} with $k \geq 1$ are outside a predetermined range.

28(new). The method according to claims 18 or 20, characterized in that a differential spectrum

$$E_{\text{diff}}(\lambda) = E(\lambda) - \sum_{j=1}^J \bar{E}_j(C_j, \lambda) ,$$

with J being the number of components, and λ being in a range covering at least 30 %, preferably at least 50 %, and most preferably about 100 % or more] of the whole wavelength range defined by the broadest combination of $\lambda_{1,1}$ and $\lambda_{1,n}$, $\lambda_{2,1}$ and $\lambda_{2,n}, \dots, \lambda_{J,1}$ and $\lambda_{J,n}$ is computed, and the differential spectrum is subjected to an analysis in view of anomalies.

29(new). The method of claim 28, wherein λ is in range covering at least 50 % of the whole wavelength range defined by the broadest combination of $\lambda_{1,1}$ and $\lambda_{1,n}$, $\lambda_{2,1}$ and $\lambda_{2,n}, \dots, \lambda_{J,1}$ and $\lambda_{J,n}$.

30(new). The method of claim 28, wherein λ is in range covering about 100 % or more of the whole wavelength range defined by the broadest combination of $\lambda_{1,1}$ and $\lambda_{1,n}$, $\lambda_{2,1}$ and $\lambda_{2,n}, \dots, \lambda_{J,1}$ and $\lambda_{J,n}$.

31(new). The method according to claim 28, wherein the curvature or the slope of the differential spectrum in at least one predetermined wavelength range is determined, the result compared with the expected value, and wherein the differential spectrum is estimated to be normal if the value compared have identical sign.

32(new). The method according to claim 28, wherein the curvature and the slope of the differential spectrum in at least one predetermined wavelength range are

determined, the result compared with the expected values, and wherein the differential spectrum is estimated to be normal if the values compared have identical sign.

33(new). The method according to claim 28, wherein the curvature or the slope of the differential spectrum in at least one predetermined wavelength range is determined, the result compared with the expected value, and wherein the differential spectrum is estimated to be normal if the value compared have identical sign, with the magnitude resting in a predetermined range given by an upper and a lower limiting curve.

34(new). The method according to claim 28, wherein the curvature and the slope of the differential spectrum in at least one predetermined wavelength range are determined, the result compared with the expected values, and wherein the differential spectrum is estimated to be normal if the values compared have identical sign, with the magnitude resting in a predetermined range given by an upper and a lower limiting curve.

35(new). The method according to claims 18 or 20, characterized in that the sample is blood, or a fluid derived therefrom, the first wavelength range is chosen in the range of 500 to 600 nanometer, the first reference spectrum $E_1(\lambda)$ being that of hemoglobin, so that the concentration C_H of hemoglobin is determinable, and the second wavelength range is chosen in the range of 400 to 600 nanometer, the second reference spectrum $E_2(\lambda)$ being that of bilirubin, so that the concentration C_B of bilirubin is determinable.

36(new). The method of claim 35, wherein the sample is human blood or a fluid derived therefrom.

37(new). The method of claim 35, the first wavelength range is chosen in the range from 545 to 575 nanometer and the second wavelength range is chosen in the range of from 480 to 545 nanometer.

38(new). The method of claim 35, the first wavelength range is from 545 to 575 nanometer and the second wavelength range is from 480 to 545 nanometer.

39(new). The method according to claim 35, wherein the lipid concentration and the overall constitution of the sample are estimated to be normal if the differential spectrum has a negative slope or a positive curvature or both.

40(new). The method of claim 35, wherein the sample is estimated to be of critical condition if the concentration of bilirubin or hemoglobin or both exceed a predetermined value, or if the differential spectrum is anomalous.

41(new). The method of claims 18 or 20, wherein the spectra are provided as electrical signals and furnished to an evaluation device comprising a processor which performs the method steps on the spectra under the control of a program, and wherein the results are stored in a storage means or presented to an operator.

42(new). The method of claim 41, wherein the storage means is a storage means for digital data.

43(new). The method of claim 41, wherein the results are presented to an operator by printing, displaying or audible sounds.

44(new). An apparatus for measuring the concentration of at least one component of a liquid biological sample before analysis of said sample by an in vitro diagnostic method, said component being apt to interfere with the measurement of a target analyte by means of said diagnostic method, for use with an analyzer, the apparatus comprising at least one photometric measurement site within a sample supply path of the analyzer.

45(new). A photometric probe for measuring the concentration of at least one component of a liquid biological sample before analysis of said sample by an in vitro diagnostic method, said component being apt to interfere with the measurement of a target analyte by means of said diagnostic method, comprising:

a body having an end part and a recess spaced from the end part;
a photometric measurement site confined by a first wall and a second wall of the recess,
a light source associated with the first wall; and
a light capturing means associated with the second wall;
wherein, the light source and the light capturing means being so arranged that light emanating from the light source passes through the measurement site and, at least to a significant part, is captured by the light capturing means.

46(new). The photometric probe of claim 45, further comprising a light guide extending past the photometric measurement site, and a light deviating means,

within the end part and arranged such that light exiting the light guide is deviated towards the first wall of the measurement site.

47(new). An analyzer with an apparatus for photometric measurements, the apparatus comprising a program memory storing a program and a device for executing the program, wherein the execution of the program implements the measurement of the concentration of at least one component of a liquid biological sample before analysis of said sample by an in vitro diagnostic method, said component being apt to interfere with the measurement of a target analyte by means of said diagnostic method.

48(new). The photometric probe of claim 46, wherein the light deviating means comprises a prism.

49(new). The photometric probe of claim 46, wherein the light exiting the light guide is deviated by an angle of substantially 180°.

50(new). The analyzer of claims 44 or 47, wherein the analyzer is a chemical-clinical analyzer

Abstract

A quality test of fluids of biological origin can be performed optically with applying a suitable evaluation method. In case of two components to be determined in a such fluid, an extinction spectrum is approximated in a first wavelength range by a combination of a merely theoretical curve and the spectrum of the pure first substance in a first wavelength range, and this evaluation is repeated in a second wavelength range this time by approximating the measured spectrum (62) by a combination of a hypothetical curve, the spectrum (64) of the first component with the already determined concentration, and the spectrum (65) of the pure second component. Furthermore, it is feasible to subtract the first and second spectrum and analyze the so obtained differential spectrum (66) in view of anomalies. The hypothetical curves are preferably straight lines which are defined by slope and ordinate section. In the praxis of the quality test of blood, bilirubin and hemoglobin may be quantitatively be determined, whilst the background together with the lipid component can be qualitatively examined by means of the differential spectrum.

(Fig. 6)